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Recommended Citation
Pollacia, Lissa; Lomerson, William; and Russell, Jack, "Improving CIS Enrollments Through Flexible Minors: An Examination of Existing Curricula" (2008). *SAIS 2008 Proceedings*. 23.
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Improving CIS Enrollments Through Flexible Minors: An Examination of Existing Curricula

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ABSTRACT

It is widely known that since the year 2000, the number of U.S. students who choose Computer Information Systems (CIS), Management Information Systems (MIS), or Computer Science (CS) as a major has declined significantly. For many CIS departments, a portion of their budget is tied to the number of student credit hours that are produced. There are ways to increase these numbers, such as offering more service courses to the general student body. A department may also consider offering new types of multi-disciplinary minors that incorporate computer-intensive courses taught by CIS and other departments throughout the university. This paper presents a review of CIS minors offered at institutions in the U.S. The results of the review shows information such as the type of minor, the number of credit hours, and the types of courses that are typically required. It is our hope that this study will provide information to assist anyone considering curriculum changes.

Keywords: CIS Program, Computer majors, Enrollment, Information Technology Curricula

INTRODUCTION

All statistical evidence points to a steady decline in the number of students who are electing to major in science, technology, engineering, and mathematics (STEM). Particularly hard hit are all computing-related fields, such as Computer Information Systems (CIS), Computer Science (CS), and Management Information Systems (MIS) (Pollacia and Lomerson, 2004). The decrease in computing enrollments coupled with a large number of pending baby-boomer retirements is expected to create a substantial shortage of skilled workers in the U.S. in the coming years (Chabrow, 2004; Kessler, 2005; Murphy, 2005).

Recent studies show that there are a variety of reasons for this decline, such as students' inaccurate perception of the computing profession, particularly with respect to job prospects and career opportunities. Other reasons cited are the dot com bust, the outsourcing of jobs overseas, the decline in students' analytical abilities, and the perception of "geek"/"nerd" for computer professionals. A large number of students indicated that they think the work will be too hard or technical (Lomerson and Pollacia, 2005; Pollacia and Lomerson, 2006).

Now the question is: what can we do about this situation? In answer to declining enrollments and increasing employer demands, many computing programs are examining ways to provide course offerings to a wider audience of students. One way to do this is by increasing the number of service courses that are used to fulfill basic electives or core requirements. Another option is the introduction of CIS minors for non-majors. A third option is to develop interdisciplinary minors in partnership with other departments throughout the university.

The authors have conducted a review of minors offered in CIS at colleges and universities in the United States. We found that a CIS minor may also be known by other names, such as Information Systems (IS), Information Technology (IT), Computing Sciences and so forth. We collected data concerning the type of minor (traditional vs. multi-disciplinary), the number of credit hours and the types of courses that are generally included. We then analyzed this data to determine commonalities and differences in these minors. Some of the innovative multi-disciplinary minors are described. It is the author's hope that this study will provide information to faculty who may be considering similar curriculum changes.

REASONS FOR THE DECLINE

In a recent survey of faculty at U.S. universities that offer a bachelors degree in Computer Information Systems, Management Information Systems, or Information Technology (Lennox, Woratschek, Davis, 2005), seventy-six (76.1%) of

the respondents reported that enrollment had decreased in the past two years. When questioned about the reasons as to why they felt that enrollment had declined at their institutions, sixty-seven (67%) blamed the outsourcing of jobs, sixty (60%) stated the economy in general, sixty (60%) cited the dot com failure, forty (40%) indicated that the drop was cyclical in nature, and twenty-seven (27%) stated it was due to decline in students' analytical abilities.

The author's own recent research has provided some information concerning the cause for the enrollment decline (Lomerson and Pollacia, 2005; Pollacia and Lomerson, 2006). In a survey of students in introductory computer literacy courses, many of the students reported that they did not choose a computer-related career due to inaccurate or insufficient information concerning computing careers. The results also show that students have a high level of dissatisfaction with their high school counseling experience, and received little or no guidance, particularly with respect to the computing profession. Other reasons cited were the lack of interest in a computer-related profession; they did not think they would like the work; they thought the work would be too hard; or they did not think that there were very many jobs available in this field.

A related study produced very similar results. Respondents in this study were business students in introductory business classes. The respondents indicated that they were knowledgeable about careers in management, marketing, accounting, and finance; and were least knowledgeable about information systems. To sum it up: "This generation, which is noted for its pervasive use of technology, has little interest in, or awareness of, the occupations that drive the digital age" (Crampton, Walstrom, and Schambach, 2006).

PERCEPTIONS VS. REALITY

In actuality, students' perceptions of career opportunities are not aligned with reality (Kessler, 2005). The majority of students have poor information and misconceptions about nearly every aspect of the profession. According to the U.S. Department of Labor, high-level jobs that combine technical and business skills are still abundant in the U.S. The Bureau of Labor Statistics projects that the number of jobs in the industry sector *Computer Systems Design And Related Services*, will increase by 54.6% from 2002 to 2012 (Bureau, 2006). In fact, the bureau predicts that eight of the eleven fastest-growing occupations through 2012 that require a bachelor's degree will be in this sector.

Other employment analysts write that the recent upturn in the U.S. economy has resulted in continued growth, and is particularly good for information systems. The hiring in information systems is slated for continued growth (Fisher, 2006; Paulson, 2006). *MONEY Magazine* and *Salary.com*, a leading provider of employee compensation data and software, researched hundreds of jobs and compiled a list of the "Top 10 Best Jobs in America" (Money, 2006). Software engineer was rated as the number one job; with "Computer IT Analyst" at number 7. The criteria for rating the jobs included projected job growth, annual salary, work environment, annual job openings, stress levels, flexibility in hours, creativity, and the opportunities for advancement in the field.

The reality is that the area of information systems is one of the fastest growing areas of employment, with high salaries and earning potential. Two of the 10 most highly rated jobs are in this area. Therefore we need to educate potential students to see information systems as an energetic and growing profession, with outstanding long-term job security, salary prospects, and prestige.

RECRUITING IN PLACE

What can we do to recruit more students? One of the low-cost measures that a CIS department may undertake is to engage in *"recruiting in place"*. This is a term that we use to describe activities to increase enrollments by recruiting students who are already enrolled in our own institutions. This requires a shift in our thinking, as we are generally focused only on our majors. We need to become more aware of the inter-disciplinary nature of CIS, and learn to collaborate with other disciplines on our campuses. A few institutions have embraced this idea of recruiting in place, and found that the most direct path to enticing students to take more CIS courses is by offering a minor that that will enhance the student's own chosen field of study.

For example, at our institution, Northwestern State University, we have recently instituted a new CIS minor that includes courses from Art and the Library. The minor consists of six courses (18 hours). Three of the courses are required to be CIS; one required course is offered through the university library; the other two courses may be additional CIS courses; Computer Science courses (offered by the Math department) or graphics art/ web design courses (offered by the Art Department) (Pollacia and Lomerson, 2004).

The motivation for delivering this curriculum is to provide more CIS offerings for the non-major, thus increasing the number of students enrolled in CIS courses. We are in the process of development of three new courses for non-majors, i.e. Introduction to Database Systems, Multi-Media Communication, and Introduction to Information Systems. The curriculum for the minor has just been approved and will be in effect for the first time in the Spring 2008 semester.

CIS MINOR

As previously stated, a CIS minor may be known by other names, such as *Information Systems* or *Information Technology*. The number of credit hours and curriculum of a CIS minor is different for virtually every institution. The majority of the CIS minors are what we call ***traditional***. The traditional CIS minor is essentially a scaled-down version of the CIS major, with all of the required classes coming from the CIS department.

We also define two other categories of CIS minors: ***composite*** and ***multi-disciplinary***. The composite minor is one where a majority of the courses are from the CIS department; however the student also takes courses from one other major area to complete the degree. The CIS/Art minor in web development described in the previous section is an example of a composite minor.

We use the term **multi-disciplinary** to designate minors that focus on the study of information technology through its application in many fields. Departments offering computer-centric courses may include art, computer science, English, journalism, biology, and so forth. There is generally a required number of courses that must be taken from the computing department before the student takes elective courses from the other departments.

An example of a multi-disciplinary minor is the IT minor at the University of North Carolina Wilmington (Patterson, Laurie, 2005). The minor requires 3 computer science courses and a course offered by the university library. This course was created specifically for the minor, and teaches the student how to conduct research using computer technology. The remaining two courses are chosen from those offered by other departments that heavily involve computer technology as a component of the course. These other areas include: Art, Chemistry, Communications, Educational Technology, English, Film Studies, GIS, Music, Logic, and Sociology.

METHODOLOGY

We gathered data about CIS minors that are offered in U.S. colleges and universities. The data was gathered via Internet search and through a search of directories (*College Blue Book, American Universities and Colleges, Patterson's American Education*) and databases (*ERIC, Professional Development Collection in Education, Business Source Premier, Computer Science Index, Computer Source, Information Science and Technology Abstracts*). This search revealed that there is no compiled listing of minors in CIS. The keywords used for the Internet search were: "minors", "Computer Information Systems" and "Information Technology". We found 137 institutions that offer a minor, and from which we could locate relevant information.

We compiled the following information about each minor: the name of the institution, the name of the minor, category (Traditional, Composite, or Multi-disciplinary), the number of credit hours, the number of elective credit hours, and any special requirements. In addition, we reviewed the courses that constituted the curriculum. The following generic course titles are those that were listed most often: 1) Introduction to Information Technology, 2) Programming I, 3) Management Information Systems, 4) Database Systems, 5) Systems Analysis and Design, 6) Web Development/Design, and 7) Telecommunications/Networks.

The raw data was initially collected into a spreadsheet. Pivot tables were used to cross tabulate most of the results found in the section below. Pearson Chi Square was used in testing the statistical significance related to the hypotheses listed in the section "Testing the Null Hypotheses."

RESULTS OF THE STUDY

Nineteen (19) different minor titles were discovered from the computer search. Only three (3) titles, CIS, Information Technology (IT) and Information Systems (IS), emerged with a significant frequency distribution and were chosen as the primary titles for this study. There were ninety-two (92) programs with the title of CIS, fifteen (15) with the title of Information Technology (IT) and nine (9) with the title of Information Systems (IS). The remaining twenty-one titles were grouped analyzed using the title of Other. This provided a survey sample of 137 curricula.

The term "Minor Title" will be used to reference CIS, IT, IS or Other. The term "Minor Category" will be used to denote Traditional, Composite or Multi-disciplinary.

Research Questions:

The authors developed a series of research questions that focus on discovering the general characteristics of these minors by examining the types of courses and number of credit hours among either the Minor Title or the Category (Traditional, Composite, and Multi-disciplinary). The following research questions are:

1. What are the average number of credit hours and elective hours among the Minor Titles?

2. What are the average number of credit hours and elective hours among the Minor Categories?
3. What was the distribution of Traditional, Composite or Multi-disciplinary minors among the different Minor Titles?
4. What was the distribution of the common courses among the Minor Titles and Minor Categories?

Research Question 1

Minor Title	Total Hours			Elective Hours			Count	Per Cent of Total
	Average	Max	Min	Average	Max	Min		
CIS	19.2	30	12	6.2	18	0	92	67%
Information Technology	18.5	27	15	6.3	12	0	15	11%
Information Systems	20.2	30	15	4.8	12	0	9	7%
Other	19.8	32	15	6.4	15	0	21	15%
Cumulative	19.3	32	12	6.2	18	0	137	

Table 1. Average Degree and Elective Hours for Minor Titles

Table 1 shows that all minors are relatively similar with the averages ranging from 18.5 to 20.2 hours and an overall average of 19.3 hours. The range of total hours, however, is surprisingly large, running from 12 hours to 32 hours. The Elective hours are also relatively similar with the averages ranging from 4.8 to 6.2 hours with an overall average of 6.2. The range of elective hours was also large, running from 0 hours to 18 hours.

Research Question 2

Table 2 below presents a comparison of the average credit hours and elective credit hours by Minor Category (Traditional, Composite and Multi-disciplinary). This analysis shows that the degrees remain very similar in total hour requirements with a range of 18.7 to 19.8 hours. The cumulative data is redisplayed to facilitate continuity of analysis when studying the tables.

Minor Category	Minor Hours			Elective Hours			Count	Per Cent of Total
	Average	Max	Min	Average	Max	Min		
Traditional	19.3	32	12	6.1	18	0	109	80%
Composite	19.8	24	15	4.9	18	0	17	12%
Multi-Disciplinary	18.7	30	15	8.8	18	0	11	8%
Cumulative	19.3	32	12	6.2	18	0	137	

Table 2. Average Degree and Elective Hours for Minor Categories

The Multi-Disciplinary category has about 50% more elective hours (8.8) than the other two categories, which is to be expected as this minor would generally target a broader academic audience that required a more varied selection of courses. The Traditional (6.1 hours) and Composite (4.9 hours) minors offer fewer electives, which is also to be expected since they tend to be more narrowly focused courses of study. The Composite degree offers the least number of electives, which is probably the result of multiple departments that each specifies its own required content thereby leaving fewer hours remaining for electives.

Research Question 3

Table 3 and Table 4 below present cross tabulations of the distribution of Minor Categories within the Minor Titles. Table 3 displays the distribution of Minor Categories within each Minor Title as a per cent based upon the number of minors within that Minor Title; this presentation enables comparison of the differences in the categories offered by the title areas. Table 4 displays the distribution of minors as a per cent based upon the total number of minors offered.

Table 3 shows that CIS and Information Systems areas are still predominately traditional in the structure of their minor offerings. Information Technology and Other, however, appear to be moving more rapidly into non-traditional offerings with one-third (33%) of the minors in these areas classified as Composite or Multi-Disciplinary. Information Technology as made the strongest move to obtain external students with 27% of its minors classified as Multi-Disciplinary.

Minor	Categories			
Title	Traditional	Composite	Multi-Disciplinary	Number of Minors
CIS	85%	12%	3%	92
Information Technology	67%	7%	27%	15
Information Systems	78%	11%	11%	9
Other	67%	19%	14%	21

Table 3: Per Cent of Minor Categories within Minor Titles

Table 4 shows that 80% of the minors offered still follow the traditional format, which in most instances is simply a scaled down version of the major. The Composite and Multi-Disciplinary offerings indicate an attempt to recognize that the IS areas have the potential to enhance the understanding and incorporation of its concepts and methodologies beneficially into other disciplines in ways that allow students to deviate from the relatively rigid Traditional course offerings.

Minor	Categories			
Title	Traditional	Composite	Multi-Disciplinary	Per Cent Of Total
CIS	57%	8%	2%	67%
Information Technology	7%	1%	3%	11%
Information Systems	5%	1%	1%	7%
Other	10%	3%	2%	15%
Cumulative	80%	12%	8%	

Table 4: Minor Categories within Minor Titles as a Per Cent of Total Minors

Research Question 4

Tables 5 displays the frequency with which the common set of courses described earlier in the paper appear within the minors examined in this study. The per cent is based upon the number of minors within each class.

	Minor Title				Combined
Courses	CIS	Information Technology	Information Systems	Other	Per Cent of Total
Programming 1	83%	73%	56%	62%	77%
Database Systems	52%	47%	44%	43%	50%
Systems Analysis & Design	45%	40%	67%	43%	45%
Introduction to IT	41%	53%	78%	19%	42%
Web Design/Development	25%	53%	33%	48%	32%
Data Communications	30%	27%	22%	38%	31%
Mgt Information Systems	28%	27%	11%	14%	25%

Table 5. Per Cent of Minor Titles Offering Common Course Titles

The data in Table 5 highlights a surprising lack of common courses with in the minors. Only two courses, Programming and Database Systems appear in fifty percent or more of the minors.

CONCLUSIONS

For several years now, U.S. colleges and universities have seen a steady decline in students majoring in STEM disciplines, particularly in computer-related fields. While there are a variety of reasons for this decline, much of the problem stems from

students' perceptions do not align with the reality which is that continued growth is predicted in the industry for many years to come. One of the ways to address this decline in enrollments is "recruiting in place", which we define to be recruitment of students who are already on campus. Developing curricula for a minor is one way to enroll more students into CIS courses. Much attention has been focused on curricula for CIS majors, but little work has been done to determine what constitutes a minor.

We collected data to determine characteristics of CIS minors currently offered by U.S. institutions. We found that, for the institutions that we examined, the overwhelming majority of CIS minors are *traditional*, meaning that all courses in the curriculum are CIS courses. A small percentage of those reviewed were *composite* minors, which means the CIS department partnered with one other department at the same institution. A small number of minors were classified as *multi-disciplinary*, where the courses that comprise the minor may come from a cross section of disciplines at the institution. In examining the course offerings within the minors, we found that there are some commonly included classes: Introduction to Programming, Database Systems, and Introduction to Information Technology. In addition, we determined that the average number of course credits required to complete the minor is approximately 19 credits, with 6 credits of electives.

This study represented the first step taken by our CIS department to develop a more flexible minor that addresses the needs of the students, which in turn would recruit more students on our own campus. We had hoped to find more multi-disciplinary minors that we could use as a model for developing one for our own campus. Future work will consist of a more thorough analysis of the composite and multi-disciplinary minors.

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